

Chapter 2

Establishing Technical Fundamentals

What sort of computer user are you? Are you comfortable using computer hardware? Are you experienced in trialing new software? Do you take a problem-solving approach when things don't go to plan? Or are you uncertain about your computer technology skills and feel anxious about moving outside your comfort zone? We recognize that people come to research from diverse backgrounds, and some researchers return to the role after an extended career break. Sometimes new (and experienced!) researchers are reluctant to acknowledge their lack of understanding of computer basics and can struggle along inefficiently without seeking appropriate assistance. The topics we cover in this chapter are what we consider to be the computer fundamentals that might be expected of you as a researcher, but which many new researchers don't necessarily have. If you are a confident computer user, the earlier sections of this chapter will already be familiar to you. However some of the later sections may offer you something new and useful.

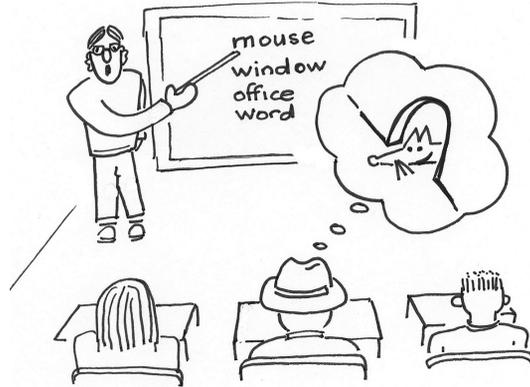
This chapter is not an A-Z on how to use computer technology and we *do* assume you are already making some basic use of computers. We offer here guidance on key fundamental concepts that provide a foundation for other sections of the book. We also provide you with skills and strategies that, from our experience, help all computer users (particularly novice ones) to become more confident in their computer learning.

In this chapter we cover:

- tips on how to learn about new technologies;
- the different types of computers available;
- guidance on downloading software and using spreadsheets, databases and graphics applications;
- basics on connecting to the Internet and accessing information from the Web;
- tips on how to use your computer more efficiently.

Learning about technology

Proficient computer users rarely develop and maintain their computer skills from using a manual or doing a formal training course. Most just “get in and have a go.” To be an effective researcher you continually need to develop new strategies and skills as your needs and context change. When it comes to learning about technology it is quite likely that “you don’t know what you don’t know.” Unless someone has shown you how to use a program, or you have seen it demonstrated or read a review, you are unlikely to be aware of how it could be useful for your research. This book is designed to serve exactly that function. It will raise your awareness of the range of technologies available to you and give you the confidence to have a go at using them yourself.



Our philosophy is that you will learn best through being an “exploratory learner,” rather than relying on formal group or individual instruction. We have a lot of experience working with computer learners and we know that strategies that facilitate ongoing, independent computer learning can be taught and learnt. For many of the individuals we work with, gaining these insights and strategies is empowering and opens up a whole new world of independent computer learning.

Strategies for exploratory learning

Nothing major can go wrong when you explore the features of your computer or software, providing you use common sense and follow the suggested strategies below:

- **Develop good risk management practices**, including backing up, versioning and virus protection (see Chapter 4). If you’re confident that you are not in danger of losing work, you can explore without fear.
- **Set goals and have the confidence to try new things.** View your learning about technology as an investment in your own professional development, not as a waste of time. Even if you try out a new piece of software and decide not to use it, you will have enhanced your general knowledge and technical skills and have increased confidence to explore other applications.
- **Look through the menus** within any program that you use. Even a program you use all the time is likely to have useful features you are not aware of. Exploring the menus and adding a new skill or two every so often can increase your skills and confidence significantly.

12 Organizing and Managing Your Research

- **Try right clicking** on icons, on desktop items, on highlighted text, in fact on anything, to discover features you weren't previously aware of. This will display a menu with all sorts of options related to that item (on a Mac the equivalent is Control-click).
- **Experiment with "drag and dropping."** There is more to it than just moving files. This action is central to the functionality of many programs.
- **Learn to use the different types of Help.** While lots of people claim that "Help" isn't very helpful (and, we agree, sometimes it isn't), frequently it is unfamiliarity and inexperience with using Help that is the problem. Spending a little time exploring the various Help options is a sound investment in research time. The three most common Help formats are:
 - **Help Contents**, which is like the table of contents of a book, with chapters on each topic. Use this when you want to read a comprehensive guide on how to do a particular task.
 - **Help Index**, which is like the index of a book. Use it to look up very specific pieces of information. Sometimes you need to try a couple of terms before you find what you are after (just as in a book index).
 - **Help using natural language searching**, which lets you type in a question when you don't know exactly what to look up.
- **Explore the Preferences, Options and/or Tools section** of any program. This is where the default settings that control how the program behaves can often be adjusted. Later in this chapter we discuss some ways you can use these to customize programs.



Want to know more about...

Computer terminology?

While we aim to keep computer jargon to a minimum and explain most terms in straightforward language throughout this book, if you encounter a term that is unfamiliar to you, try one of the following Web-based technology dictionaries:

- | | |
|--------------------|---|
| • Webopedia | http://www.webopedia.com |
| • Computeruser.com | http://www.computeruser.com/resources/dictionary |
| • Whatis.com | http://whatis.techtarget.com |
| • FOLDOC | http://foldoc.org |
| • Computer Hope | http://www.computerhope.com/jargon.htm |

Hardware fundamentals

In 1948, the journal *Popular Mechanics* predicted that “in the future computers will probably weigh less than 1.5 tons.” Such a notion seems laughable to us today, given the diversity of professional and consumer level hardware that sit on our desktops, our laps, or in the palms of our hands. Advanced research is exploring the development of molecular level computers, several hundreds of thousands times smaller than silicon-based circuitry. Super fast, million dollar supercomputers measure their calculating speed in tera-flops (trillions of calculations per second). Some are purpose-built machines (such as IBM’s Blue Gene) while others such as Virginia Tech’s System-X consist of more than a thousand Apple Mac G5 servers, the same G5s that you can buy over the counter.

Researchers’ computer hardware needs vary greatly, as do their budgets and the level of support provided by their institutions. No doubt you do already have access to some form of computer configuration. However, in our experience, many researchers find themselves reconsidering their hardware needs when beginning a new project or phase of their research career. For example, you may to date have used a desktop computer, but because of a new need to travel or collect data in the field, may be considering a laptop or palmtop. Our intention here is to list the main types of computers you are likely to encounter and some of the issues associated with each, focusing on general purpose rather than specialist computers.

Types of computers

Desktops take up the space of about the size of two A4 pages and with the need for a separate monitor, keyboard and mouse they certainly are not the sort of computer you want to be moving around on a regular basis. Desktops tend to have faster processor speeds and more storage space than average laptops and are generally cheaper. They are also more easily customized. For instance, you can replace or upgrade components, add extra hard drives, or increase Random Access Memory (RAM).

Workstations are computers that use the latest and most powerful processors. They are suited to handling large amounts of data or running specialist software and might be considered as “desktops on steroids.”

Laptops, also called **powerbooks** or **notebooks**, weigh in at one to two kilos, have adequate processing power for most office jobs, but often have limited hard disk storage and only modestly sized screens. Their advantage over desktops is their portability. If needed, their capabilities can be boosted by attaching external hard disk drives and a large monitor. In your office, you can use a docking station, a piece of equipment that sits on your desk with all the peripherals (such as mouse, keyboard etc.) and cables already connected.

14 Organizing and Managing Your Research

Palmtops (or their less sophisticated cousins, **Personal Digital Assistants** or PDAs) are small computers that can be held in one hand and operated by the other. Processing speed and storage are sacrificed for portability and size. If you need a computer to support your data collection in the field, or an electronic organizer which you can carry with you and synchronize with your main computer, these machines may be just what you need. Most now allow you to handwrite on the screen and the palmtop performs character recognition to convert to typewritten text. While it is generally very effective, it can take a little time to adjust to how some characters need to be formed. Palmtops and PDAs can also incorporate digital camera and video capabilities, wireless and Bluetooth (a short-range form of wireless) connectivity, inbuilt mobile phones and Global Positioning Systems (GPS).

Servers are computers (or related devices) that have been set up to provide a specific type of network functionality. They are usually permanently connected to the network they serve and run 24 hours a day, 7 days a week. One of the oldest types of servers is a file or FTP server. Its role is to control the secure storage and transfer of files between other computers on the network. Another common server is a mail server, one specifically set up to move and store e-mail. Other servers include chat, discussion list, proxy, Web etc. In fact, more than one server function can run on one machine at the same time, but in high traffic environments each function is often dedicated to a separate machine. Consumer laptops such as Mac Powerbooks have the Apache Web server application built into the operating system so you can run your own Web server whenever you are on a network.



Want to know more about....

Computer hardware?

Many sites on the Web review current hardware models, for example:

- CNET <http://reviews.cnet.com>
- Download.com <http://www.download.com>
- Winplanet <http://www.winplanet.com>
- MacReviewZone <http://macreviewzone.com>

Numerous sites also provide advice on buying hardware, for example:

- Desktops <http://www.computerhope.com/btips/desktop.htm>
- Laptops <http://www.infohq.com/Computer/LaptopGuide.htm>
- DAs <http://www.geeks.com/pix/techtips-21APR05.htm>
- Supercomputers <http://www.top500.org>

Software fundamentals

Software is a generic term that refers to the programs that allow your computer hardware to do what you want it to do. Without software, your computer would only really be useful as a paper weight! There are two broad categories of software, operating systems and application and utility software.

Operating system software

Operating system software provides a user-friendly environment for you to interact with your computer's hardware. Common operating systems (or platforms) are:

- **Windows.** Examples include 2000, Millennium and XP.
- **Macintosh.** Examples include OS8, OS9, OSX (as in Roman numeral 10).
- **Linux** is a free, open-source operating system, meaning that its underlying source code is available to the public and anyone can freely use, modify, improve or redistribute it. Originally used by technologically oriented people (some might say "geeks"), Linux has become much more user-friendly and is now widely used, particularly by people wishing to avoid being locked into big proprietary software companies.
- **UNIX** is the oldest and most well-established operating system. It was developed by programmers for programmers and provides multiuser and multitasking capabilities.

Various software products allow you to run (or emulate) a Windows environment within a Macintosh or Linux operating system. As you might expect, the software runs a little slower than on a similarly powered Windows computer, but the big advantage is that you can instantly switch (or "toggle") between operating systems.



Want to know more about ...

Emulating a Windows operating system?

Macintosh

VirtualPC <http://www.apple.com/macosx/applications/virtualpc>
<http://www.microsoft.com/windows/virtualpc>
iEmulator <http://www.iemulator.com>

Linux

CrossOver <http://www.codeweavers.com>

Office

Unix

Wine <http://www.winehq.com>

16 Organizing and Managing Your Research

Application and utility software

Application and utility software provides particular functionality to your computer. Applications are large, multifunctional programs while utilities are smaller with a defined function. While there are thousands of applications and utilities available, there are some fundamental types that are essential aids to research, most of which we consider in this book:

- word processing (Chapter 12);
- e-mail applications (Chapter 6);
- Web browsers (this chapter with further detail in Chapter 8);
- spreadsheets (this chapter with further examples throughout the book);
- databases (this chapter with further examples throughout the book);
- graphics applications (this chapter, with further references in Chapters 3 and 13);
- utilities such as note taking (Chapter 3) and virus protection and backup (Chapter 4).

Of course, throughout this book we also consider a range of additional specialist software relevant to research.

Applications often come bundled as a package, for example, Microsoft Office includes word processor, spreadsheet, e-mail, calendar, database, Web browser and presentation applications. There are other bundled (and individual) applications available, including some which are shareware, freeware or open source (free). For example, you might like to investigate and perhaps even try out OpenOffice (<http://www.openoffice.org>) – an open-source multiplatform and multilingual office suite, free to download, use, and distribute (see below regarding software licensing). Other examples include NeoOffice <http://www.neooffice.org/> and Thinkfree Office <http://www.thinkfree.com/common/main.tfo>.

File formats and file names

When you save a document created in any one of these many applications, it will be saved in a particular file format. On many operating systems the format of the file is distinguishable by 1–4 letters (typically 3) that appear at the end of the file name, separated by a full stop (period). These are known as file extensions. For example, Word files have a .doc extension; Rich Text Format is .rtf; and photos are generally in .jpg or .jpeg format (short for Joint Photographic Experts Group, and pronounced jay-peg). Some file extensions are proprietary to particular application software (for example .xls for Microsoft Excel; .nsf for Lotus Notes databases; and .dsf for Micrografx Designer). Other file extensions are more generally used, for example .wav are waveform audio files; and .png are Portable Network Graphics files. *It is important not to delete the file extension from the end of your file name or your computer may have difficulty identifying which program opens it.* A comprehensive listing of file extensions is provided on Wikipedia (<http://www.webopedia.com>).

Many programs allow you to open files in one format and save them to another (using the “Save As” function). This is highly valuable if you need to move files between different applications or share files with others (e.g. moving data from a spreadsheet to a quantitative data analysis program, or converting a project logo to a format that can be used on a website).

Software licensing

Throughout this book we refer you to many software products that you may find beneficial to your research. Knowing that researchers generally have very limited budgets, we have attempted to balance our coverage of commercial products with those that are free. It is, however, important to understand the meaning of several software licensing terms, so that you can make the most efficient budgetary decisions.

- **Freeware** is computer software that is made available free of charge, but with some licensing restrictions, e.g. that the software cannot be copied, modified or redistributed. This is different from *free software* that can be used, copied, modified and redistributed but may or may not be free of charge. In both cases, support may be limited or not provided at all. “Adware,” a variation on freeware, doesn’t require you to hand over any money, but you do pay a price in being exposed to advertisements embedded in the display. “Donationware” (sometimes referred to as “beggarware” or “nagware”) is distributed for free with the authors asking users to make a donation to themselves or to a charity. More malicious are “baitware” products that are very limited or defective freeware intended to attract users to commercial products. “**Open source**” freeware (or public domain software) are applications where the source code for the program is available to the public. Anyone who knows how to write programs can change or modify it, although there are usually restrictions, such as not being able to market the original or change source code, or a requirement to include an acknowledgement statement with all modified code.
- **Shareware** is software that is fully functional and that you can download and try out to see whether you like it. If you do, you pay a fee to continue using it. Much shareware expires (usually in 14 or 30 days) and no longer works fully (or at all). Users are generally encouraged to copy and “share” unregistered versions of the software, with the aim that others will also pay the fee to gain full use of the program.
- **Commercial or proprietary software** is controlled by a single person or company (with copyright protection) and only they can change or distribute it and, of course, you pay for it. Many commercial programs are, however, provided as **demonstration versions** on the software website. In these instances (and there are many cited in the software tables throughout the book) you can install and use the program, generally for a set number of days (e.g. 14 or 30). Some demonstration versions provide full functionality while others are restricted (e.g. you may not be able to save files).

18 Organizing and Managing Your Research

Selecting and downloading application software

General points to be aware of when selecting software to support your research are listed below. Note that we provide specific tips in relation to particular types of applications where applicable throughout the book.

- **Operating System compatibility.** Check that the software you are considering is compatible with your operating system, including the version of the system (e.g. some software may be compatible with Windows XP but not Windows 2000).
- **Hardware requirements.** The software should state the minimum memory, hard drive space, processor speed etc. it requires to run the software.
- **The user interface,** or how “user-friendly” it is, will be influenced by the familiarity of the menus and icons, its on-screen displays, the range of shortcuts provided and so on.
- **Support.** Your choice of software should be informed by the availability of support resources such as books, online help and tutorials, online user groups and perhaps the availability of people in your institution who are familiar with the program.
- **Export and import features.** The ability to move data between different programs will be important if you ever choose to change software or if you want your files to be accessed by other researchers.
- **Palmtop compatibility** may be a great bonus if you want to move data between your palmtop and desktop or laptop.
- **Cost and licensing.** Many programs are quite expensive if purchased as a single license. It is worth checking whether your institution or any other researchers already have a multiuser license or would be prepared to contribute to one.



Want to know more about...

Selecting and downloading software?

Many sites provide reviews of software, as well as direct download access to demonstration or full versions of software, for example:

- TuCows <http://www.tucows.com>
- CNET download.com <http://www.download.com>
- Versiontracker.com <http://www.versiontracker.com>

For Palmtops

- Handango <http://www.handango.com>
- PocketGear.com <http://www.pocketgear.com>

In the following sections we give detailed attention to four general purpose applications that are fundamental across the spectrum of research activity: spreadsheets, databases, graphics applications and programs that create and/or view PDF documents.

Spreadsheets

In our experience many researchers, particularly those from the social sciences and humanities, have had very limited exposure to spreadsheet programs. Yet they are one of the most versatile and useful applications a researcher can use.

Spreadsheets are specifically designed for entering, editing, manipulating and printing structured, tabular information, and were originally designed for tasks that required calculation such as accounting ledger sheets. Their primary function is to perform numerical operations on data, particularly mathematical and/or statistical functions. However, they have much greater potential in supporting both quantitative *and* qualitative research. Because a spreadsheet can be set up as a simple database, many people confuse spreadsheets with database applications. Databases are designed to handle and search large amounts of textual information and for outputting in very specific formats.

A spreadsheet is made up of rows and columns with the intersection between them forming a cell, as illustrated in Figure 2.1 below. Each row and column has a label; rows are labeled with numbers while columns are labeled with capital letters. Thus each cell (the intersection between a row and a column) has a name, e.g. A1, D5 etc.

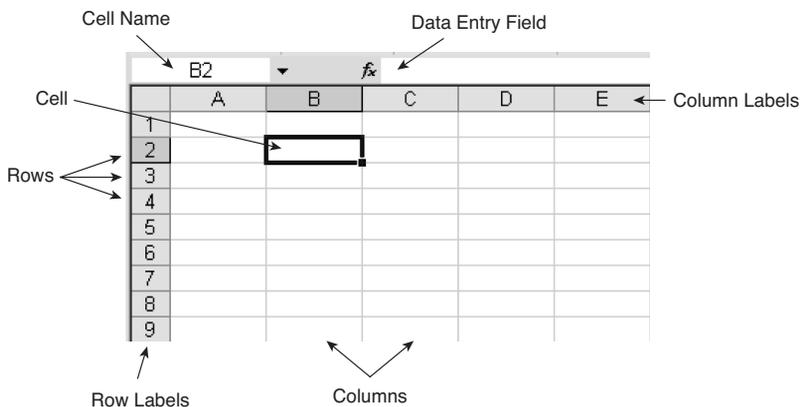


Figure 2.1 The general appearance of a spreadsheet, showing basic nomenclature.

While all spreadsheet applications vary slightly, they generally have these features. Example is from Microsoft Excel.

20 Organizing and Managing Your Research

Words or numbers can be entered into cells by clicking into the cell and typing. As you type, the characters appear in the data entry field (although they may also appear in the cell). After typing in the cell you hit Enter/Return or click "OK" (sometimes a tick is used) and the content is entered in the cell. You can move from one cell to another using the Tab key or the arrow keys on your keyboard. Alternatively, you can position your cursor each time with your mouse.

Each row and column will normally start with a label in the first cell which indicates what the data in that row or column relates to.

The real strength of spreadsheets lies in their ability to perform mathematical calculations automatically.

- Operations.** All operations begin with the = sign and use + for addition, - for subtraction, × for multiplication, or / for division. In the example in Figure 2.2, to find out the sum of John's responses to variables 1, 2 and 3, type into cell F2 the following mathematical operation: =C2+D2+E2.
- Functions.** These provide a more efficient alternative to manually performing operations. They range from basic mathematical operations such as average, maximum, minimum or frequency, to more complex statistical or logical operations. All functions also begin with the = sign. For instance, to calculate the sum of John's three responses (C2, D2 and E2 above) you could type into cell F2 the following mathematical function: =SUM(C2:E2). The colon represents a range of cells including C2 and E2 and all cells in between. Similarly, to work out the average response to variable 1 and display the result in cell C9 you could type into cell C9 the following

	A	B	C	D	E	F
1	Pseudonym	Gender 1=M 2=F	Variable 1	Variable 2	Variable 3	
2	John	1	5	3	2	
3	Aaron	1	3	4	4	
4	Sally	2	5	3	3	
5	Bill	1	2	5	2	
6	Rani	2	4	2	5	
7	Don	1	3	2	3	
8	Daniella	2	5	5	3	
9	Tarek	1	2	3	3	
10						
11						

In this example row 1 has been selected and formatted so that the text wraps to the next line. The depth of the row can then be varied to display text on two lines.

Figure 2.2 Entering data entry into a spreadsheet

Note that Row 1 and Column A contain labels describing the data. Example is from Microsoft Excel.

mathematical operation =AVERAGE(C2:C8) Your program will provide you with a list of available functions (see the Insert menu or Help).

The advantages of using a spreadsheet for mathematical operations is that if, for instance, you need to adjust one of the responses or scores, the sums or averages will automatically update. Spreadsheets enable you to sort your data based on the contents of any one or more rows or columns. Another useful feature of spreadsheets is their ability to create graphs and charts in a range of formats, as illustrated in Figure 2.3.

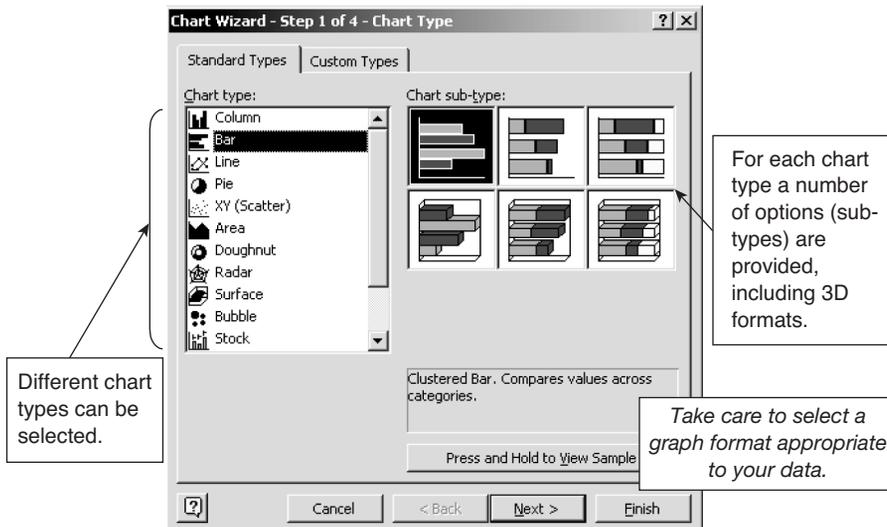


Figure 2.3 Examples of graph formats provided by spreadsheet programs

Some graph formats are more appropriate to particular data than others. For example, pie charts and 100% stacked bar charts display relative portions of a whole (suitable for nominal and ordinal data – see Chapter 11), while a simple bar chart displays and compares interval data. Example is from Microsoft Excel.

We provide further examples and details on how spreadsheets can be used to support your research throughout the book. In particular, Chapter 5 explores the use of spreadsheets to establish and manage a research budget; Chapter 7 provides an example of how a spreadsheet can help you to manage your literature searching; and Chapter 11 discusses their use in data analysis.

Databases

It is critical to have an understanding of what is meant by a database before you read this book as throughout we discuss a range of general, as well as

22 Organizing and Managing Your Research

very specific, database functions and programs. At one level, a database is just a collection of information (or data) that is stored in some orderly way. For instance, old library card catalogues and your pocket address book are both examples of databases. However, in a computer sense, database applications are programs designed to facilitate the storage of electronic data that can then be easily searched, sorted and accessed.

Databases can be customized for a wide range of research purposes. You are probably familiar with library databases, those designed to provide access to journal articles, conference papers, reports etc. (discussed in Chapter 7). Others include databases for managing bibliographic references (Chapter 9) or for organizing data (Chapter 10). Even the address book function of your e-mail program (Chapter 6) is a database.

Databases consist of both *records* and *fields*, and it is important to understand these terms in order to use databases effectively. Think of your address book (electronic or hardcopy). Within it you are likely to have an entry for each friend or acquaintance. Each one of these entries is a record. For each of these people you will record certain pieces of information, name, address, phone number and so on. In an electronic database each one of these categories of information is a field, and you can search your address book using a particular term in one or more fields. A typical electronic address book database is shown in Figure 2.4.

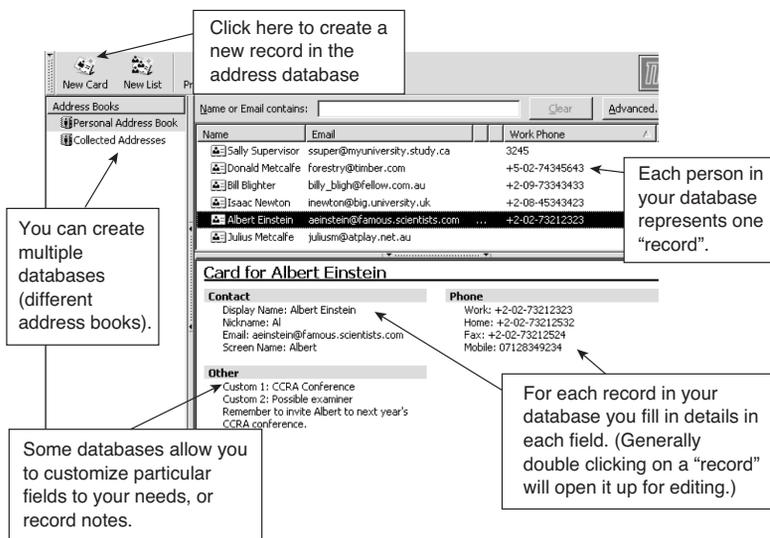


Figure 2.4 Address book database showing records and fields

Each person in your address book represents one 'record' while the types of information that you record (name, work number, e-mail address etc.) represent the fields. Example is from Mozilla.

Databases are also very valuable for finding sets of data, sorting them in a particular order and displaying or printing them out in particular formats. For example, you might use the information in your address book to search for all records marked "CCRA Conference" and use this found set to e-mail out a conference invitation or call for papers. A range of strategies can be used to refine database searches, which we consider in more detail in Chapter 7.

Graphics and photographic applications

Throughout your research process there may be times when you want to present your ideas, data or planning processes visually. A range of graphics applications make this easy to do. In other sections of this book we mention mind mapping and visualization software (Chapter 3), software for creating Gantt charts (Chapter 5), how to use images or photos as a source of data (Chapter 10), and graphs and charts (see the section on spreadsheet in this chapter, and quantitative data analysis software in Chapter 11). There are two main types of graphics applications for creating and modifying images:

- **Drawing programs** create vector images which are made up of lines, curves, rectangles and other objects. You can edit, move or rearrange individual lines or shapes. You can also group and ungroup objects, so that if they are resized they will retain their original definition and perspective. Many commonly used word processing or presentation programs include a basic drawing facility within them. There are also drawing programs available as freeware, shareware and commercial software.
- **Paint programs** create or manipulate bitmap pictures (including photos) which are made up of a series of small dots. All scanned graphics and photographs are bitmaps. When they are enlarged, they lose definition and the individual dots that make up the picture become visible. Computers with Windows installed include a basic Paint program (Windows Paint), but again freeware, shareware and commercial programs are available.

Which graphics program should you use?

This decision will depend on the type of images you are creating, what you want to achieve, and your level of interest and skill in learning to use the software.

- **For simple diagrams or flowcharts**, the drawing tools within programs such as Microsoft Word or PowerPoint may be sufficient.

24 Organizing and Managing Your Research

- **For more advanced diagrams, logos and complex images including scanned components** you will probably need more professional level software and will face a decision as to whether you do it yourself or have someone do it for you. There are many advantages in learning to create and modify images yourself, since you can continue to refine them as your research progresses.

With knowledge of just a few basic concepts and understanding you can start creating and modifying basic graphics. The following should get you off and running:

- **Creating layers**, which are different levels of an image built up over a period of time. Most of the more advanced graphics programs allow you to work with multiple layers, enabling you to edit, change, move or delete components of the overall artwork without disturbing other components.
- **Creating a text box** into which you can put words *or* use it simply as an object (such as a square or circle). These are used to position each element of your diagram on the page (like using layers) by dragging and they can be grouped or set to display in front or behind other objects. Modify the text box by exploring group, ungroup, order, align, rotate and crop functions found on the drawing toolbar.
- **Using appropriate file formats.** Each program has its own proprietary image format, but will also allow you to save images in standard formats. Graphics Interchange Format (.gif) is generally used for vector images such as line art, logos, cartoon images or Web art such as buttons and backgrounds, while jpeg format is generally used for photographs. When creating your own images, save working versions in the program's proprietary format which retains information about the layers and development process. When the image is finished, you can then convert it to a widely accessible format if you need to distribute it or insert it into another document.
- **Screen grabbing** is a particularly useful skill if you want to represent in a document an image of something on your screen. Many keyboards have a Print Screen key (sometimes it requires the function key to be used) which copies your computer screen to memory so that you can paste it into your word processing document or graphics program. A range of utilities also provide more sophisticated screen grabbing functionality, as do most graphics programs.

You can also access software that creates very specific types of images such as timelines, molecular structures, architectural drawings and laboratory equipment.

**Want to know more about...**

Graphics applications?

To locate other graphics software, search a software download site. Try searching for these common programs: GIMPshop (Open source freeware), ConceptDraw, CorelDraw, PaintShop Pro, PhotoShop, Timeline Maker or Visio.

PDF documents

Portable Document Format (PDF) is a special proprietary file format that displays an image of a document on a screen exactly as it would look if printed. PDF (file extension .pdf) is widely used for the distribution of journal articles, books, reports, manuals and other research documents. While using Acrobat Reader to view and print documents is fairly straightforward, we consider PDF here in some detail because, in our experience, few people understand how to use such documents effectively.

The most commonly used program to *create* PDF documents is Adobe Acrobat *Writer*. There are, however, other shareware and commercial programs available and the Mac OSX operating system has PDF functionality built in. Adobe Acrobat *Reader* is a free program used to simply *view* PDF documents. Most computers will already have it installed as it usually comes bundled with other programs such as Web browsers (discussed below). Note these particular issues when using PDF:

- **PDF documents can be very large** in terms of file size and can take a long time to download if you have a slow Internet connection.
- **You cannot change PDF documents, but you can copy and paste from them.** To do so, however, you must select the text tool  or  before you highlight blocks of text.
- **Some PDF documents are created with security features** so that functions such as saving, printing or highlighting to copy and paste are blocked. This is usually because the author or distributor does not wish to allow such functionality.

Adobe Acrobat Reader also incorporates e-book viewing and management functionality (see Chapter 7 for more information about e-books). There are also various utilities available which make it much easier to view PDF documents on palmtops.

26 Organizing and Managing Your Research



Want to know more about...

PDF applications?

- Adobe Acrobat <http://www.adobe.com>

To locate other PDF software (such as PDF Converter, PDF Creator Plus and deskPDF Professional), search a software download site.

Networking fundamentals

Are the Internet and the World Wide Web the same thing? While many people have this impression, in fact they are not. While no doubt all researchers have at least some experience using the Internet and Web, we provide a little historical information for background.

The Internet, known originally as ARPANET, was conceptualized in 1962 as a global network of computers and became a reality in 1969. As a product of the Cold War, one of its key design concepts was to provide a communications network that would work even if some sites were destroyed by nuclear attack. From its initial implementation across four university sites, it quickly spread to other universities and research organizations, then to commercial organizations and finally into the home. Thus the Internet is a network of computer networks that enables a variety of functions, including the World Wide Web, electronic mail, mailing lists, chat rooms and file transfer. This is achieved by a set of international agreements or protocols to ensure that computer files and programs can be transferred among different computers running different operating systems.

The World Wide Web (WWW or the Web) was conceived in 1989 by two engineers, Robert Cailliau and Tim Berners-Lee, at CERN, a physics research facility in Geneva. Its initial purpose was to aid communications between physicists working on large global collaborative projects. The Web is essentially a hypertext system. This simply means that you navigate by clicking on links (known as hyperlinks) which then display another document. The Web uses the Internet as its transport mechanism but it also relies on international standards and rules for communication, also known as protocols.



Want to know more about...

The World Wide Web and Internet?

- The Internet Society <http://www.isoc.org/internet/history>
- The Internet <http://www.walthowe.com/navnet/history.html>
- The WWW Consortium (W3C) <http://www.w3.org/WWW>
- LinkScan http://www.elsop.com/wrc/h_web.htm

Connecting to the Internet

There are various ways to connect to the Internet, all of which use different technologies (copper wires, optical fiber, wireless signals) and vary in speed and reliability. Indeed, your connection will almost invariably involve several or all of these. For example, in your home you might connect via wireless signal to a small base station, which connects to an ADSL modem that is connected to your telephone line which consists of a copper wire connection to the local exchange at which point the connection changes to optical fiber.

A second way to describe your Internet connection is in relation to its bandwidth or “speed.” Bandwidth, an old term from electrical engineering, refers to the *capacity of the connection* (i.e. how much data the network can transmit). It is commonly measured in bits per second (bps).

The following briefly describes the common types of Internet connection and the range of speeds you can expect from each.

Dial-up modems (originally stand-alone devices but now built into most computers), allow you to connect to the Internet via your standard telephone line. Such connections involve copper phone lines and are relatively slow, usually in the range of 33–44 kilobits/second (kbps). They are prone to disconnecting if the signal quality on your line is poor.

Broadband refers to data transmission where multiple pieces of data are sent simultaneously to increase the effective rate of transmission. A number of technologies deliver broadband services:

- Digital Subscriber Lines (DSL) are a family of technologies (one of which is Asymmetrical Digital Subscriber Lines, ADSL) that provides digital transmission over the last few kilometers of the local telephone network. Such services are not available in a local area until the local exchange has the required specialist equipment. Conventional ADSL download rates (the speed at which you can bring files and programs from the Internet to your computer) start at 256 kbps and can go as high as several thousand kbps. Upload rates (the speed at which you can send files or programs from your computer to another) start at 64 kbps and can go up to around 512 kbps. DSL is a connection that is “always on,” which means you do not have to dial-in each time you want to use the service. What’s more, it also allows normal phone operation so you don’t need a special line to connect.
- Cable modems are a special type of modem designed to modulate a data signal over optical fiber infrastructure (typically used for cable television). They are typically rated at 1500 to 3000 kbps for downloads and 400 to 600 kbps for uploads.

Wireless connectivity allows connection without cables and can be achieved in a number of ways. A personal digital mobile phone can provide a slow 14.4-kbps connection. Wireless base stations used in libraries, downtown coffee shops or in the home can run between 11 and 54 megabits/second (mbps), but keep in mind that, as with all shared systems, this rate drops as more users are added to the system. Wireless LANs (Local Area Networks) that are set up to cover downtown and suburban areas are able to deliver high bandwidth (speed) connections even when there are many simultaneous

28 Organizing and Managing Your Research

users. Satellite Internet systems are really a special form of wireless base station but usually involve relatively low speeds (around 400 kbps).

Institutional connections, the type used in universities and research laboratories, usually involve Ethernet networks that provide local data transfer speeds varying from 10 s to 100 s of mbps. Outside connections to the Internet or other research institutions will also be in the mbps or gigabits/second range, or even higher speeds. Extremely high speeds are needed for projects involving massive amounts of data (such as particle physics or weather prediction).



Want to know more about...

Your current Internet connection speed?

You can test the speed of your connection for free at:

- Bandwidthplace <http://www.bandwidthplace.com/speedtest>
- Speakeasy <http://www.speakeasy.net/speedtest>

Accessing information on the Web

In this section we provide some definitions and easy-to-understand explanations of a few terms related to accessing information on the Web. We use these terms throughout the book and know that for many researchers clarification of the terms will be useful.

Web browsers

To access information on the Web you need a client application called a browser. This allows you to interact with a Web server to download and view or listen to text, graphics, digital video and sound files. Web browsers essentially facilitate the process of hyperlinking. In other words, clicking on a hyperlink (usually underlined in blue) causes the computer to display the linked document. You could think of a Web browser as providing point and click file transfer.

Examples of browsers include Mozilla Firefox, Opera, Safari, Camino, Netscape, Fast Browser Pro and Internet Explorer. As website technology continues to evolve, we advise you to keep up-to-date with the latest version of your preferred browser.

Proxy settings

Most commercial Internet Service Providers (ISPs), universities and other institutions require you to enter what is called a “proxy setting” into the preferences/options area of your Web browser in order to access websites. The proxy settings decrease the amount of long-distance Internet traffic by storing a local copy of a webpage on the ISP’s server (for a short time) once someone has

looked at it. This means that the next time the page is viewed (within this time) it is loaded from the local server. Your institution or ISP will generally provide you with step-by-step directions on how to configure your proxy settings.

Plug-ins

A plug-in is a small additional program that operates within your browser to enable it to read, view or listen to particular types of material on the Web (such as graphics or video material). Plug-ins need to be installed separately and most have to be updated regularly as well, as newer versions are made available. Examples include Java, JavaScript, Shockwave and Flash. You may be prompted to download a plug-in when viewing some webpages.

HTML and XML

Hypertext Markup Language (HTML) and Extensible Markup Language (XML) are parts of the established international standards for information distributed on the Web. In other words, they are the coding systems that contain the information displayed on webpages, the rules for displaying it and the nature of the information being displayed. The average computer user doesn't need to know the technicalities of either HTML or XML because if you choose to create a website, there is software that creates the coding for you (see Chapter 6). However, as we make mention of HTML and XML throughout this book, we provide here a brief, simplified explanation.

HTML is coding that lies "behind" a webpage, telling your Web browser *what* to display and *how* to display it. For example, to start a new paragraph the code `<p>` is used; to display something in bold you start and end the bold coding with `bold text`. XML, on the other hand, allows you to give your data meaning i.e. to describe what data on your page refers to, for example `<item>Mac powerbook</item>` or `<price>$2100</price>`. In XML, unlike HTML, you create your own "tags" (the words that appear inside the triangular brackets) and you can hence customize them to your own needs.

By way of example, a popular music application, iTunes, uses XML to store data about each song. This data can then be used to search for and build a play list of a particular music genre or artist. XML is an important component of the Semantic Web.¹



Want to know more about...

XML?

A range of books are currently in publication (and more appear all the time) on XML. Try a search in your local or online bookshop. The following websites are also useful:

- The World Wide Web Consortium <http://www.w3.org/XML>
- An Introduction to XML <http://www.xmlfiles.com/xml>

30 Organizing and Managing Your Research

Having covered some of the fundamental technical information that should assist you in reading this book, we now turn to ways in which you can become more efficient in how you use your computer.

Increasing your technical efficiency

There are various ways of increasing your technical efficiency, ranging from purchasing new equipment or software to learning new skills. In this section we focus on typing skills, voice recognition software, customizing your software, recording macros, pasting links and special formatting.

Developing your typing skills

The standard QWERTY keyboard was designed in the 1800s for mechanical typewriters to slow typists down to avoid jamming the keys. Despite this historical legacy, one skill that can enhance your computer efficiency is fast and accurate typing. While some individuals become very proficient at typing with two fingers, for most people becoming more efficient means learning to use all their fingers on the correct keys. There are ergonomic and efficiency reasons for decreasing hand movements and for associating particular keys with particular fingers. There is a wide range of software available which teaches and reinforces typing skills, however ultimately there is no substitute for consciously trying to use correct fingers while you are typing up your research. There are, of course, other types of keyboard layouts (and shapes) that are designed to increase typing efficiency, which you might want to investigate (for example, do a search for Dvorak).

Using voice recognition software

While typing skills will continue to be important, voice recognition software has the potential to dramatically decrease the need for typing and reduce the incidence of repetitive strain injuries. Essentially these programs allow you to speak into a microphone plugged into the computer and the software will interpret your speech and turn it into text. While this might sound like the answer to all your typing problems, there are a few issues to consider when using this software:

- The software has to be “trained” to recognize your voice. While this can be quite quick initially, you need to keep training it when it makes a mistake, rather than making the corrections manually.
- You need to speak at a steady pace, preferably not too slowly. As the software uses both speech and language data, it needs you to talk in your

- natural speaking voice to make an assessment of what it is you are saying. This is easier when you are reading something, but more difficult when you are thinking and dictating.
- Voice recognition can prove more time consuming, particularly since considerable checking and correcting is required. Editing your work can be slower than using a mouse until you are used to it, as you need to keep giving instructions about where you want to go in your document and what you want to do.
 - While it does not make any typographical errors, the software does *not* eliminate the need for careful proofreading. It is easy to miss small words (in, at, of etc.) that the software has added as you dictate. It is most likely to do this if you pause frequently while you are speaking.
 - It can be distracting for others if you are working in a shared work area to hear you speaking to the computer and you may not want them to hear what you are writing!
 - The most important thing to remember is that accuracy will improve with time and practice. Perseverance through the initial frustrations is essential and could save you much time and typing discomfort in the long run.

Examples of voice recognition software include Advanced Recognition Technologies; Dragon Naturally Speaking; Fonix; Philips Speech Recognition; Sensory Fluid Speech; Speech Works; Via Voice and iListen.

Text to speech software

As well as voice recognition software, there is also software that does the reverse, converting text to voice. Voice synthesis software converts text into spoken audio which you can then listen to on your PC or create MP3 or WMA files for use on portable devices like MP3 players, palmtops and CD players. Text to speech software can be used to listen to articles read aloud (perhaps while you go for your morning walk or while commuting), to proofread your own writing and for translation into different languages. It is also invaluable for people with visual impairments. Many programs provide a range of “voices” to choose from, with different genders and accents. Examples include TextAloud, Natural Voice Text to Speech Reader, 2nd Speech Center and SmartRead.

Customizing keyboard shortcuts, toolbars and menus

Using **keyboard shortcuts** can save time and effort, particularly when performing repetitive tasks, as they keep your fingers on the keyboard rather than having to shift your hand to the mouse. There are many standard shortcuts that are consistent across most programs such as:

32 Organizing and Managing Your Research

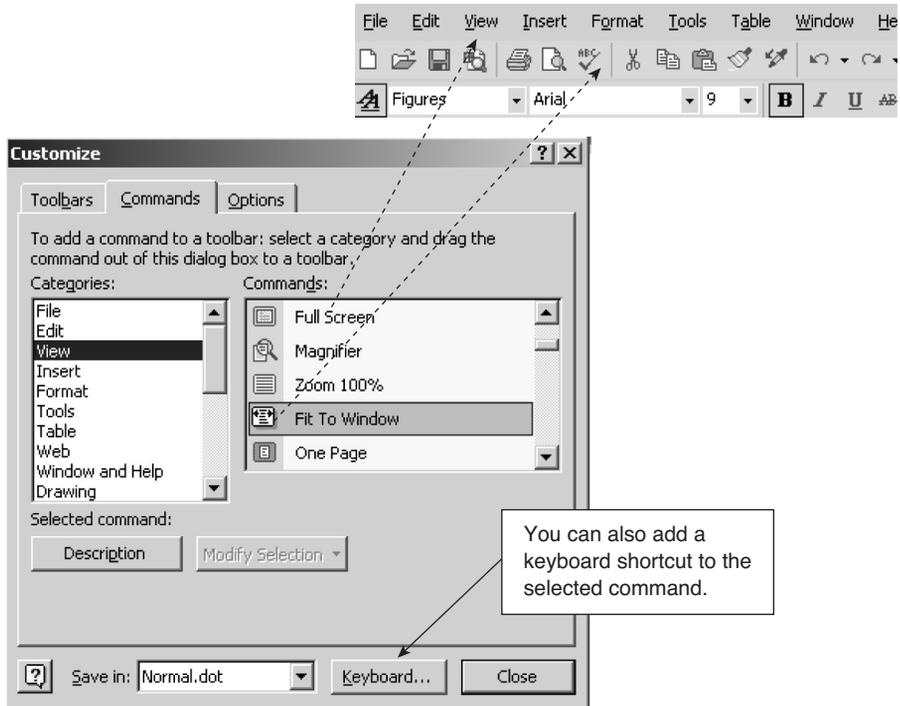


Figure 2.5 Customising toolbars in your word processor or other program

If there are particular functions that you perform repetitively, you can increase efficiency by customising your toolbars and menus. In this example, the “Full Screen” function is being added to the View menu and the “Fit to Window” icon is being added to the toolbar by dragging and dropping. Example is from Microsoft Word.

- Control-C for copy;
- Control-V for paste;
- Control-X for cut;
- Control-F for find;
- Control-S for save;
- Control-Z for undo;
- Control-Y for repeat.

Most programs list shortcuts next to menu items, or you can look up a list in Help. Many also allow you to customize the keyboard shortcuts, allowing you to add your own to particular functions or change those already assigned. You can also customize toolbars (the rows with the small image-based icons which perform set functions) and menus (the text-based lists that drop-down at the top of the screen to provide functionality), as illustrated in Figure 2.5.

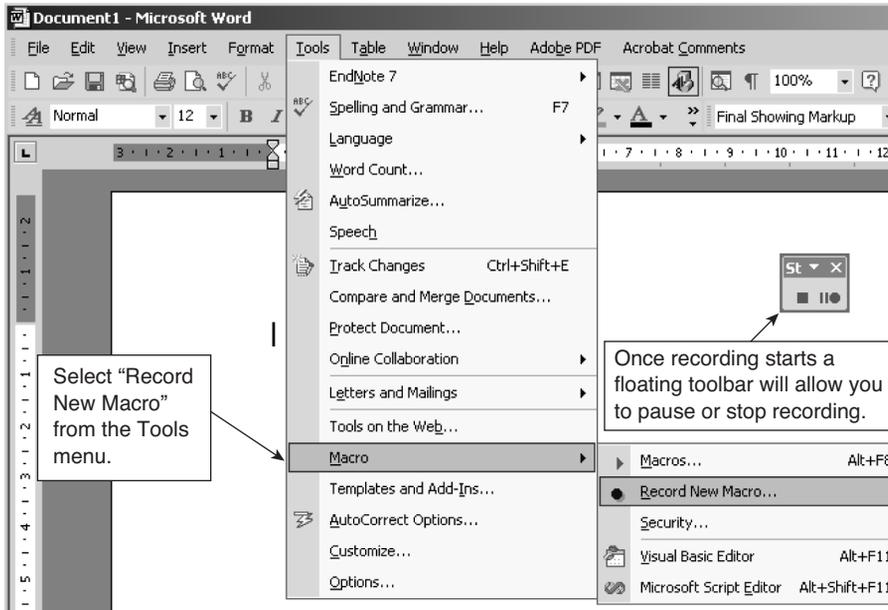


Figure 2.6 Recording a macro

Many programs allow you to record a sequence of steps and allocate these to a single button or function. In this example from Microsoft Word, "Record New Macro" has been selected. Recording of your current actions has started and the recording toolbar allows you to pause or stop recording when your action is complete.

Using macros

A macro is a simple way of programming a series of commands or instructions which are grouped together as a single function or action. If you find yourself performing a task repeatedly, a macro can make this more efficient. When word processing, for example, you might want to speed up a series of actions such as inserting a table with a specific number of rows and columns and then formatting its borders and text. See Figure 2.6 for an example of how macros are recorded.

Pasting links and special formatting options

"Pasting a Link" (part of the "Paste Special" command in the Edit menu) enables you to include data in a document that you may wish to keep updating as your research progresses. For example, imagine you have some data or a graph that you have created in a spreadsheet program, which you want to include in a word-processed draft of your research report. However, you know that some of the data will continue to change as you update your

34 Organizing and Managing Your Research

figures. Rather than having to redo the graph each time you update the spreadsheet, you can copy the graph from the spreadsheet and paste a link to it in your report. Then when the data changes and the graph updates in the spreadsheet, so will the graph in your research report.



Over to you...

1. What learning strategies might you adopt in order to continue to expand your computer skills?
2. How could spreadsheets be useful for you in your research? If you have not done so before, try entering a simple set of data and explore some of the mathematical manipulations you can do and the graphs and displays you can use.
3. To what extent do you think you could make use of databases in your research?
4. How could you use graphics in your research?
5. What steps could you take to improve your computer proficiency and efficiency? Make a list of the most common tasks you perform and learn the associated keyboard shortcuts.

Note

- 1 The Semantic Web has been defined as “an extension of the current Web in which information is given well-defined meaning, better enabling computers and people to work in cooperation” (Berners-Lee et al. 2001).